HURRICANE OF JULY 5, 1916, AT PENSACOLA, FLA.

By WILLIAM F. REED, Jr., Local Forecaster.

[Abstracted for the MONTHLY WEATHER REVIEW.]

The first information at Pensacola concerning the tropical disturbance of July 5 came at 10:43 a. m., Sunday, July 2, when it was reported near Swan Island in latitude 17° N., longitude 84° W. At 9:33 p. m., July 3, an advisory message was received giving its location as latitude 20° N., longitude 85° W. and moving north or northwest. On the morning of the 4th an advisory message stated that the late reports of the 3d indicated that the disturbance had passed through the Yucatan Channel, and warning cards were sent to all shipping interests and posted by messenger. All advices concerning the development and progress of the storm were published in the newspapers and on the daily weather maps. An advisory message received at 2:15 p. m. on the 4th stated that at noon the disturbance was in the southeast Gulf of Mexico, but there were no reports to indicate its intensity or exact direction of movement, and shipping was advised to remain in port until further advices. At 9:03 p. m. on the 4th an order was received to hoist northeast storm warnings from Bay St. Louis to Pensacola, with information that no information was available as to the location of the Gulf storm, but its center was probably near the middle Gulf moving northwest and caution was repeated for vessels to remain in port.

A gentle to moderate southeast breeze on the afternoon of the 4th decreased to light winds between 5 to 7 p. m., then a moderate northeast breeze set in, increasing to fresh by 12 p. m. A moderate surf along the Gulf beach in the afternoon, as if from local conditions, fell off with the wind but at night it became high and alarming, and the few people who were at the bathing pavillions on Santa Rosa Island sought refuge at the Coast Guard Station.

On the morning of the 5th all were aware that the hurricane was nearing the coast and every precaution was taken to protect life and property. The flagstaff on the roof of the American National Bank Building broke off at a splice in the pole and fell to the ground with the storm flags about 5:45 a. m. during a 40-mile gale. About 7:30 a. m. a rescue tug was called for to go to Santa Rosa Island, as the Coast Guard Cutter *Penrose* could not weather the increasing storm. Capt. Aiken of the Aiken Tow Boat Co., said he would send a tug by the island while moving some fishing smacks across the bay, which would be without cost; the tug *Simpson* was sent across, but could not make a landing. She was nearly swamped in the bay and sought shelter at quarantine station and the bluffs on the peninsula, returning to Pensacola on the 6th.

The tide at 8 a. m. was 3 feet above normal high water; at 9:30 a. m., 3½ feet and steadily rose to 5 feet by 2 p. m., remaining at 5 feet until 6:30 p. m. when it began to fall. About 2 p. m. the tide flooded the engine room of the Pensacola Electric Co.'s Power Plant, shutting off all light and power current.

A steady rain set in at 3.05 a. m. on the 5th and continued all day, shutting off the view; objects about 3 miles away could be seen when the rains were lightest.

The regular 7 a. m. observation on the 5th gave the pressure 29.57 inches, wind northeast, 48 miles, and nimbus clouds from the east; a special observation at 8 a. m. reported a pressure of 29.58, wind 72 miles from the east-southeast, and nimbus clouds east-southeast, high surf and tide 3 feet above normal. An observation at 10 a. m. reported pressure 29.51, wind 75 miles southeast, maximum wind 79 miles from the east, and nimbus clouds from the southeast. The 10 a. m. message was the last one that could be sent as wires were falling and the radio station was disabled. In taking readings for special observations from roof apparatus at 8 a. m., 10 a. m., and 3 p. m., a rope was tied to the observer, W. F. Reed, jr.; no attempt was made to get to the instrument shelter or raingage at 1 p. m. when a 92-mile gale with severe puffs from the southeast was blowing, so the office registers were consulted for the temperature and precipitation items usually obtained from the roof.

When the wind passed the 80-mile rate people could not stand at the cross streets, and when they attempted to cross were thrown down and had to creep if they could not hold on to something. Automobiles could not make headway against the wind and had to seek shelter or be blown around at the mercy of the wind; a few were turned over.

The special readings of the mercurial barometer (Table 1) were taken by W. F. Reed, jr., local forecaster, and Gerald S. Kennedy, assistant observer, in the Weather Bureau office on the 10th floor of the American National Bank Building. There was considerable vibration in the building during the storm and pumping of the barometers necessitated averaging the settings of the vernier. This vibration, combined with the moist air which was carried and driven into everything by the high winds, caused broadening of lines on the registering instruments, especially the barograph and thermograph.

A copy of the barograph trace sheet for the 5th, 6th, and 7th is shown in figure 2 on p. 397.

The duration of the gales was extraordinary owing to the slow northerly progress of the storm after it reached the Mississippi coast; and when it curved eastward from central Mississippi on the morning of the 7th moving slowly into northern Alabama by the night of the 8th, it caused south to southwest gales of 40 miles or over at Pensacola from 9 a. m. the 7th to 2 p. m. on the 8th. A tabulation of the winds and rainfall on July 5, 6, 7, and 8 is given herewith.

TABLE 1.—*Special barometer readings at Pensacola, Fla. (reduced to sea-level).*

[By W. F. Reed, jr., and G. S. Kennedy.]

Hour (90th M.).	June 5, 1916.	June 6, 1916.
A. M.	*Inches.*	*Inches.*
7:00	29.57	29.84
8:00	29.58	.....
9:00	29.54	.....
9:30	29.52	.....
10:00	29.51	29.89
10:30	29.48	.....
11:00	29.46	29.90
NOON	29.43	29.90
P. M.		
12:30	29.40	.....
1:00	29.37	.....
1:30	29.31	.....
2:00	29.37	.....
2:30	29.37	.....
3:00	29.36	.....
4:00	29.35	.....
5:00	29.40	.....
5:30	29.44	.....
6:00	29.47	.....
7:00	29.51	.....
8:00	29.54	.....

TABLE 2.—*Hourly observations at Pensacola, Fla., July 5–8, inclusive, 1916.*

Time. (90th meridian).	July 5, 1916. Wind. Prevailing direction.	Hourly movement.	Maximum. Velocity.	Direction.	Time.	Hourly rainfall.	July 6, 1916. Wind. Prevailing direction.	Hourly movement.	Maximum. Velocity.	Direction.	Time.	Hourly rainfall.	July 7, 1916. Wind. Prevailing direction.	Hourly movement.	Maximum. Velocity.	Direction.	Time.	Hourly rainfall.	July 8, 1916. Wind. Prevailing direction.	Hourly movement.	Maximum. Velocity.	Direction.	Time.	Hourly rainfall.
		Mls.	*Mls./hr.*			*In.*		*Mls.*	*Mls./hr.*			*In.*		*Mls.*	*Mls./hr.*			*In.*		*Mls.*	*Mls./hr.*			*In.*
A. M.																								
12–1	ne.	25	.....	.....	.....	T.	s.	58	67	s.	12:03	0.01	s.	32	.....	.....	.....	0	sw.	39	50	sw.	12:19	T.
1–2	e.	28	.....	.....	.....	T.	s.	59	61	s.	1:17	0.01	s.	32	.....	.....	.....	0	sw.	37	42	sw.	1:19	0.30
2–3	e.	33	.....	.....	.....	0	s.	55	60	s.	2:26	0.04	s.	34	.....	.....	.....	0	sw.	31	45	sw.	2:52	0.10
3–4	e.	39	46	e.	3:17	T.	s.	56	60	s.	3:13	0.03	s.	35	.....	.....	.....	0	sw.	40	46	sw.	3:32	0.24
4–5	e.	37	40	e.	4:53	0.05	s.	54	56	s.	4:28	0.01	s.	37	.....	.....	.....	0	sw.	38	49	sw.	4:05	0.10
5–6	ne.	42	46	e.	5:45	0.10	s.	52	58	s.	5:10	T.	s.	36	.....	.....	.....	0	sw.	40	46	sw.	5:54	0.20
6–7	e.	45	48	ne.	6:52	0.02	s.	51	55	s.	6:04	T.	s.	34	.....	.....	.....	0	sw.	40	49	sw.	6:08	0.06
7–8	ne.	46	68	e.	7:56	0.35	s.	49	52	s.	7:19	T.	s.	35	.....	.....	.....	0	sw.	41	49	sw.	7:34	0.03
8–9	e.	49	64	e.	8:45	0.34	s.	50	53	s.	8:43	0.03	s.	38	.....	.....	.....	0	sw.	42	48	sw.	8:02	0.01
9–10	e.	67	79	e.	9:53	0.05	s.	48	50	s.	9:34	T.	s.	41	44	s.	9:17	T.	sw.	31	50	sw.	9:08	1.27
10–11	e.	77	84	e.	10:42	0.10	s.	46	48	s.	10:02	0	s.	40	43	s.	10:06	0.01	sw.	41	44	sw.	10:33	0
11–12	se.	83	90	se.	11:35	0.29	s.	43	48	s.	11:13	0	s.	38	40	s.	11:03	T.	sw.	38	42	sw.	11:35	0
P. M.																								
12–1	se.	91	96	se.	12:48	0.13	s.	41	44	s.	12:32	T.	s.	38	42	s.	12:46	0.01	sw.	38	42	sw.	12:55	0
1–2	se.	92	104	se.	1:29	0.50	s.	37	43	s.	1:02	0.01	s.	41	44	sw.	1:27	T.	sw.	34	40	sw.	1:12	0
2–3	se.	79	84	se.	2:02	0.27	s.	36	40	s.	2:39	0	s.	44	44	sw.	2:13	T.	sw.	34	.....	.....	.....	0
3–4	se.	81	86	se.	3:07	0.08	s.	34	.....	.....	.....	0	s.	45	46	s.	3:42	T.	sw.	38	.....	.....	.....	0
4–5	se.	80	85	se.	4:32	0.08	s.	32	.....	.....	.....	0	s.	44	46	s.	4:10	0	sw.	36	.....	.....	.....	0
5–6	s.	78	84	s.	5:30	0.02	s.	30	.....	.....	.....	0	sw.	42	44	s.	5:05	0	sw.	35	.....	.....	.....	0
6–7	s.	68	73	s.	6:06	0.04	s.	28	.....	.....	.....	0	sw.	41	42	sw.	6:22	0	w.	26	.....	.....	.....	0.11
7–8	s.	66	72	s.	7:27	0.02	s.	30	.....	.....	.....	0	sw.	41	42	sw.	7:39	0	w.	20	.....	.....	.....	1.46
8–9	s.	62	68	s.	8:42	T.	s.	31	.....	.....	.....	0	sw.	47	52	sw.	8:49	0.05	sw.	15	.....	.....	.....	0
9–10	s.	63	68	s.	9:40	0.08	s.	33	.....	.....	.....	T.	sw.	26	44	sw.	9:55	0.27	sw.	18	.....	.....	.....	0.03
10–11	s.	69	74	s.	10:33	0.01	s.	31	.....	.....	.....	0	sw.	44	47	sw.	10:42	0.04	w.	14	.....	.....	.....	0
11–12	s.	72	80	s.	11:10	0.02	s.	34	40	s.	11:05	0	sw.	48	50	sw.	11:40	T.	w.	12	.....	.....	.....	0
Total	.....	1,472	.....	.....	.....	2.55	.....	1,018	.....	.....	.....	0.14	.....	933	.....	.....	.....	0.38	.....	778	.....	.....	.....	3.91
Mean	.....	61.3	.....	.....	.....	.....	.....	42.4	.....	.....	.....	.....	.....	38.9	.....	.....	.....	.....	.....	32.4	.....	.....	.....	.....
Extreme velocity		110 se. at 1:32 p. m.						76 s. at 12:07 a. m.						58 sw. at 8:58 p. m.						54 sw. at 12:21 a. m.				
Highest temperature		81° F.						81° F.						80° F.						80° F.				
Lowest temperature		74° F.						76° F.						73° F.						71° F.				

Average hourly wind velocity 6 a. m. 5th to 6 a. m. 6th, 66.8 miles.
Average hourly wind velocity 6 a. m. 5th to 12 noon 5th, 61.2 miles.
Average hourly wind velocity 12 noon 5th to 6 p. m. 5th, 83.5 miles.
Average hourly wind velocity 6 p. m. 5th to 12 midnight 5th, 66.7 miles.
Average hourly wind velocity 12 midnight 5th to 6 a. m. 6th, 55.7 miles.

DAMAGE BY WIND.

One would think that the damage by wind during this storm would be much greater than the results observed and listed,[1] as compared with the storm of September 27, 1906, when the gales attained the rate of only 80 miles or over during 3 hours of record, the maximum rate for 5 minutes being 83 miles from the southeast. The fact remains, however, that back to the beginning of Weather Bureau's records at Pensacola, which was on October 27, 1879, there were no storms showing greater velocities than the 72 miles from the north on July 7, 1896, so that when the storm of September 27, 1906, came with its rate of 83 miles, the structures that were weakened by decay or not properly built, the old roofs and the old trees had to go, leaving little for the gales of 80 miles or over in this storm to do. It is thought, too, that the gales of this storm did not carry the characteristic severe puffiness of hurricane winds, but were comparatively steady.

The estimated damage by wind in Pensacola and vicinity and to ships' rigging is $150,000, while that caused by tide and wave action in undermining, tearing down, shifting of sand and other materials, breaking up of wharves, and shifting and breaking up of vessels, is $850,000, making a total of $1,000,000.

[1] Mr. Reed has listed the casualties in great detail. They are not given here on account of lack of space. No lives were lost, and no single casualty was of abnormal character.

The damage by wind and water was of the character incident to such storms, and was widely and quite evenly distributed. In the city and vicinity sheds, roofs, smokestacks, etc., were blown away, and many houses were unroofed. The damage to trees, shrubbery, and crops is difficult to estimate. Sycamore and chinaberry trees suffered most, and a full line of trees on Chase Street, near the courthouse, was blown down. Trees are down and limbs broken off in all portions of the city many falling across the streets and obstructing traffic.

Seven hydroplane hangars blew down at the aeronautic station. They were made of canvas, but the engines and pontoons were removed to brick buildings and saved from damage.

Small craft and wreckage were strewn all along the water front from the harbor entrance to Escambia Bridge. Nearly all structures along the docks suffered more or less severely, and a great many vessels, mostly small ones, were wrecked or blown ashore. A detailed account of these casualties would be but a useless repetition.

High winds at Pensacola.—In connection with the popular queries arising from this recent storm Mr. William F. Reed, jr., compiled a table of previous high winds (velocities of 50 miles per hour or over, maintained for at least 5 minutes) recorded by Weather Bureau or Signal Service instruments at Pensacola, Fla. The compilation is here presented as Table 3.

TABLE 3.—*Recorded occasions with winds attaining 50 miles per hour or over, at Pensacola, Fla., from Nov. 14, 1879, to July 20, 1916.*

[Maximum velocities maintained for 5 minutes or more.]

Five-minute velocity.	Direction.	Date.	Five-minute velocity.	Direction.	Date.	Five-minute velocity.	Direction.	Date.
Mls./hr.			*Mls./hr.*			*Mls./hr.*		
50	n.	Sept. 9, 1882	54	se.	Feb. 21, 1910	76	se.	May 11, 1912
60	sw.	Aug. 20, 1888	54	e.	Feb. 26, 1910	59	se.	Sept. 13, 1912
50	sw.	Jan. 21, 1891	50	se.	Apr. 15, 1910	71	se.	Sept. 14, 1912
52	s.	Aug. 17, 1892	36	sw.	Apr. 24, 1910	50	s.	Oct. 18, 1912
50	sw.	Dec. 31, 1892	58	s.	Nov. 28, 1910	60	s.	Jan. 26, 1913
57	w.	Apr. 20, 1893	52	se.	Dec. 22, 1910	56	sw.	Feb. 27, 1913
66	sw.	Oct. 2, 1893	60	s.	Feb. 19, 1911	54	s.	Mar. 21, 1913
56	se.	Nov. 27, 1893	53	e.	Mar. 26, 1911	52	s.	Sept. 5, 1913
52	se.	Aug. 7, 1894	52	se.	Apr. 5, 1911	60	se.	Feb. 6, 1914
68	ne.	Oct. 8, 1894	52	nw.	Apr. 11, 1911	62	se.	Nov. 27, 1914
72	n.	July 7, 1896	68	e.	Apr. 26, 1911	60	se.	Nov. 28, 1914
54	se.	Mar. 23, 1901	66	e.	Apr. 27, 1911	52	s.	Feb. 5, 1915
70	sw.	Aug. 15, 1901	50	e.	June 3, 1911	54	nw.	June 25, 1915
60	sw.	Dec. 28, 1901	58	se.	Aug. 10, 1911	50	ne.	July 10, 1915
52	sw.	Feb. 27, 1902	80	se.	Aug. 11, 1911	60	se.	Sept. 29, 1915
60	sw.	Mar. 29, 1906	56	s.	Aug. 12, 1911	64	s.	Sept. 30, 1915
52	ne.	Sept. 26, 1906	56	nw.	Nov. 12, 1911	70	sw.	Dec. 28, 1915
83	e.	Sept. 27, 1906	60	e.	Dec. 19, 1911	51	s.	Mar. 25, 1916
50	s.	May 31, 1907	80	se.	Dec. 20, 1911	52	s.	Apr. 7, 1916
63	s.	Aug. 19, 1909	52	sw.	Jan. 8, 1912	66	s.	June 13, 1916
53	n.	Aug. 28, 1909	58	sw.	Feb. 21, 1912	104	se.	July 5, 1916
64	se.	Sept. 20, 1909	62	nw.	Mar. 11, 1912	67	s.	July 6, 1916
60	s.	Sept. 21, 1909	50	s.	Mar. 14, 1912	52	sw.	July 7, 1916
52	se.	Dec. 12, 1909	56	s.	Apr. 17, 1912	50	sw.	July 8, 1916
60	s.	Feb. 17, 1910						

HURRICANE OF JULY 5–6, 1916, AT MOBILE, ALA.

By ALBERT ASHENBERGER, Meteorologist.

[Dated: Weather Bureau Office, Mobile, Ala., July 28, 1916.]

The hurricane of July 5–6, 1916, was more destructive within the city limits of Mobile than any other storm in the recorded meteorological history of this section.

THE WARNINGS.

On Sunday July 2 a telegram was received from the Central Office as follows:

Tropical disturbance central short distance north of Swan Island, approximately latitude 17° north, longitude 84° west; apparently moving north or northwest.

The information was bulletined; and the warning was published in the Mobile Register on July 3. Subsequent warnings received were bulletined and given to the press; on July 4, the harbormaster and the pilots' office were informed that no vessels should leave port, and the Mobile Item published two of the warnings. The storm warning received at 9:13 p. m. July 4 was bulletined, repeated to the substations on the Alabama coast (except Fort Morgan, the telegraph office to which was closed), and published in the morning Mobile Register of July 5. The hurricane warning received at 9.53 a. m. July 5 was given extraordinary dissemination; and in the work the office had the cooperation of the Mobile & Ohio Railroad, the Louisville & Nashville Railroad, the Home Telephone Co., and the Southern Bell Telephone & Telegraph Co. At about 11 a. m. the chief of police was requested to notify parties along the river front that high tides were expected. The telegraph line to Fort Morgan was down from July 4, and the telephonic communication to points in Baldwin County, Ala., was interrupted before the warning could be sent out.

METEOROLOGICAL CONDITIONS.

No unusual cloud formations or optical phenomena were observed on the day preceding the storm. A thunderstorm occurred on the afternoon of July 4; light rain began between 4 and 5 a. m. of July 5 and the gusty character of the wind was noticeable at about 4:30 a. m. of the 5th.

On July 4 there was a slight decrease in barometric pressure, but there were only gentle winds excepting a squall with a maximum velocity of 33 miles, from the east, which occurred at about 3 p. m., during the thunderstorm. The barometric pressure decreased steadily on July 5, the fall becoming more rapid until about 3.06 p. m. at which time the rapid fall ceased and the wind reached its highest velocity, a maximum of 107 miles an hour from the east. (See fig. 2, p. 397.) The barometer registered a minimum of 28.92 inches at 3:45 p. m. July 5 and began to rise rapidly after 6 p. m. Prior to the squall on July 4 the wind was prevailingly from the southeast; subsequently it varied from east to north till about 9 p. m., after which it came constantly from the northeast till noon of July 5. In the afternoon it gradually veered to east, changed to southeast between 4 and 5 p. m., and was generally south after 11 p. m. The wind reached a velocity of 26 miles an hour at 4:55 a. m. July 5; and a maximum of 44 miles at 10:07 a. m. was the highest in the forenoon. The wind increased rapidly after noon, reaching 60 miles an hour at 12:15 p. m., after which higher velocities were registered at intervals until the highest was reached at 3:06 p. m. The hourly wind movement from 3 to 4 p. m. was 99 miles; from 4 to 5 p. m., 81 miles; from 5 to 6 p. m., 88 miles; from 6 to 7 p. m., 91 miles; from 7 to 8 p. m., 84 miles; and then there was a decrease. The record was lost from 9:55 p. m., July 5, to 6:35 a. m., July 6, owing to a broken wire. A maximum of 40 miles an hour on July 6 last occurred, beginning at 9:04 a. m.

The rain which began on the morning of the 5th continued to 1:59 p. m. of the 6th, but was interrupted from 11:45 a. m. to 12:55 p. m. of the 6th. The total was 8.56 inches. Heavy rains on July 7, which amounted to 4.99 inches, caused considerable damage in unroofed houses, and the obstructions near the river caused the water to cover the lower floors in buildings on Water Street.

THE TIDES.

The tide in Mobile River was observed to be below normal at about 5:30 a. m. July 5. The water began to rise rapidly near midday, and Deputy Harbormaster Farrell reported that at 4:45 p. m. it began to come over the wharf at the foot of St. Francis Street, although it had entered Water Street about a half hour earlier, probably through the sewers. The highest stage was reached at about 10:30 p. m. July 5, and there was no marked fall until about 2:30 a. m. July 6. The entire wholesale business district was inundated, and on St. Francis Street the water extended inland about four blocks. The water receded very slowly and only disappeared from the streets about 4 p. m. July 6. City Engineer Wright Smith contributes in Table 1 the measurements of the height of the tides which have occurred during the last six storms. He has not yet had time to check the last measurement.

TABLE 1.—*Stages reached by tides accompanying recent storms at Mobile, Ala.*

Year.	Above mean low tide.
	Feet.
1893	8.8
1901	8.23
1906	9.87
1909	8.7
1915	7.2
1916	11.6